

June 15, 1926.

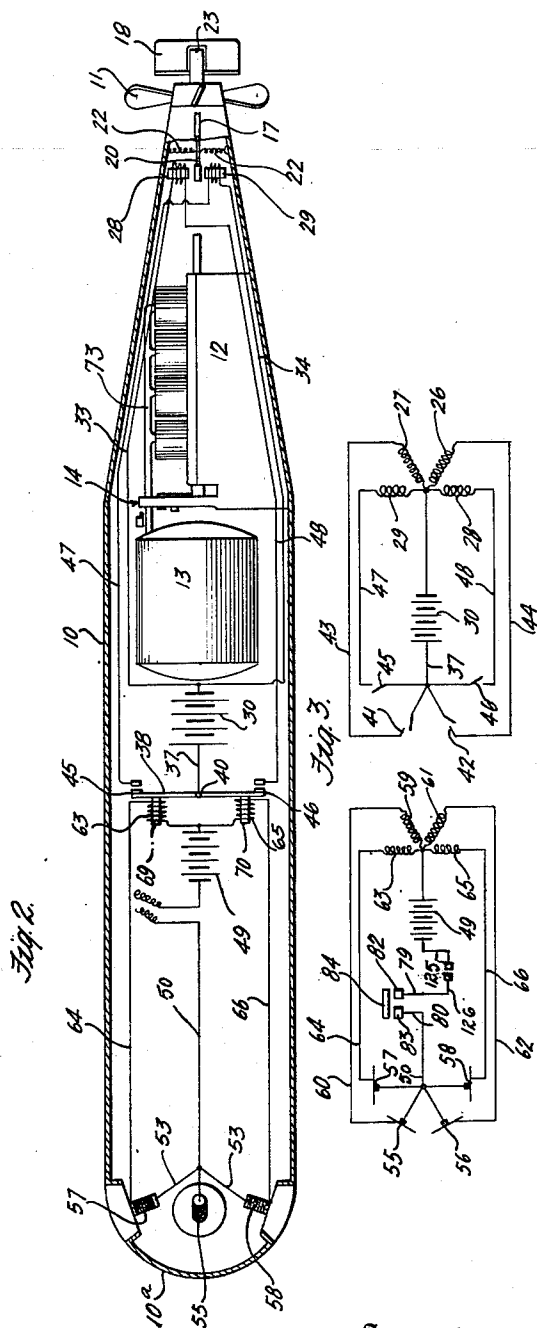
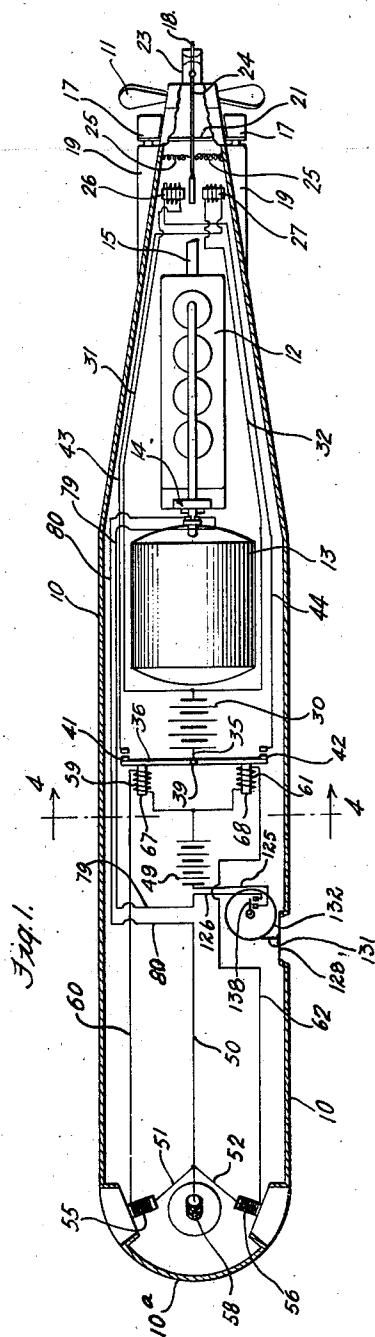
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R. S. BLAIR

ART AND APPARATUS FOR WARFARE

Filed May 29, 1924

3 Sheets-Sheet 1



Inventor
Robert S. Blair

June 15, 1926.

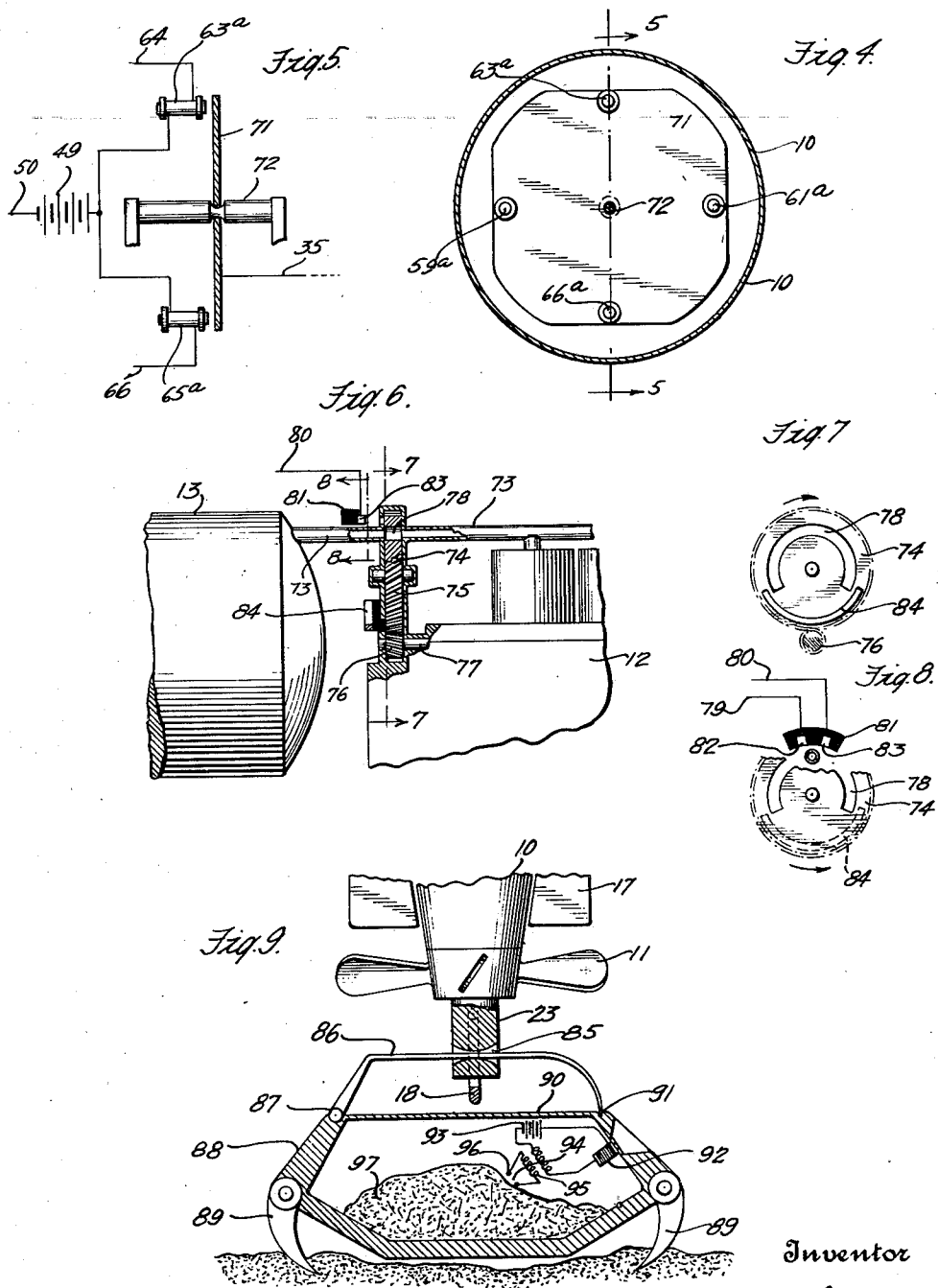
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3 Sheets-Sheet 2



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Robert S. Blair

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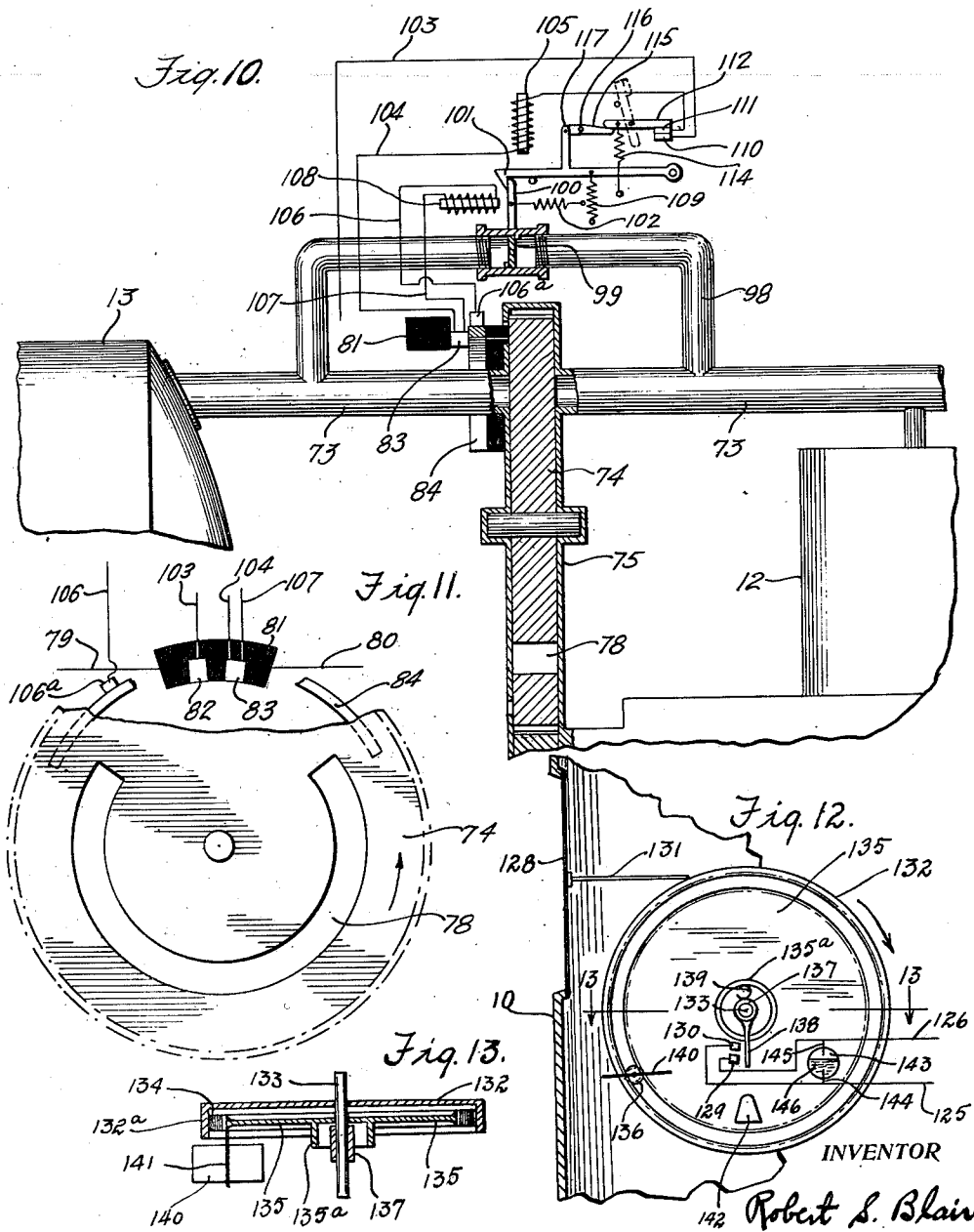
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3 Sheets-Sheet 3



Patented June 15, 1926.

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UNITED STATES PATENT OFFICE.

ROBERT S. BLAIR, OF STAMFORD, CONNECTICUT.

ART AND APPARATUS FOR WARFARE.

Application filed May 29, 1924. Serial No. 716,614.

This invention relates to warfare and more particularly to torpedoes or mines and the art or methods of operating the same.

One of the objects of the invention is to provide a device of the above general nature adapted to operate reliably to disable an enemy vessel. Another object is to provide a practical device of the above nature capable of traveling accurately and without human control to strike an object. Another object is provide such a device adapted to travel toward and strike a vessel moving in any course. Another object is to provide a device of the above nature adapted to be maintained in readiness and automatically launched at the proper time to strike and disable a vessel. Another object is to provide a practical and efficient art of disabling enemy vessels which may be conveniently and effectively carried on. Other objects will be in part obvious or in part pointed out hereafter.

The invention accordingly consists in the features of construction, combinations of elements, arrangements of parts and in the several steps and relation and order of each of the same to one or more of the others all as will be illustratively described herein, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings in which are shown one or more various possible embodiments of the several mechanical features of this invention:—

Figure 1 is a longitudinal section through the device the section being taken along a lateral plane.

Figure 2 is a longitudinal section in a vertical plane.

Figure 3 is a diagrammatic representation of electric circuit shown in Figures 1 and 2.

Figure 4 is a section taken substantially along the line 4—4 of Figure 1 showing a modified form of certain parts.

Figure 5 is a section along the line 5—5 of Figure 4.

Figure 6 is a detailed view showing a form of valve mechanism employed in the apparatus of Figures 1 and 2.

Figure 7 is a section substantially along the line 7—7 of Figure 6.

Figure 8 is a section along the line 8—8 of Figure 6 with certain added parts to bring out their relative positions.

Figure 9 is a section through an anchoring means not shown in preceding figures.

Figure 10 is a view similar to Figure 6 on a larger scale and showing parts omitted from Figure 6.

Figure 11 is a detail of certain parts shown in Figure 10.

Figure 12 is an enlarged view of a circuit-closing mechanism shown in Figure 1.

Figure 13 is a section along the line 13—13 of Figure 12.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now to Figures 1 and 2 of the drawings in detail, there is diagrammatically shown a casing 10 having preferably the general outlines of a marine torpedo. The head 10^a thereof is adapted to contain an explosive charge which, upon the torpedo striking an object, is adapted to explode in the usual manner with destructive force. At the rear end of the torpedo is a propeller 11 adapted to be driven by suitable driving means to propel the torpedo through the water. As illustrative of a suitable means, there is shown a motor 12 adapted to be driven by compressed air contained within a storage reservoir or tank 13. The supply of compressed air to the motor 12 is controlled by a valve mechanism indicated generally at 14 in Figures 1 and 2, which valve mechanism will be later described in detail. The motor 12 is adapted to rotate the propeller 11 through a drive shaft 15, these parts being not shown in detail, since they may be of any well-known type.

For controlling the direction of travel of the torpedo through the water, there are provided at the rear end thereof, a pair of controlling rudders 17 and 18 positioned at right-angles to each other. In the arrangement selected in the drawing, the rudder 18 controls the direction of movement of the torpedo in a lateral plane, whereas the

rudder 17 serves as a depth controlling rudder. The rudder 17 is preferably hinged on longitudinal vanes 19, as shown in Figure 1, and (as shown in Figure 2) its position is controlled by an arm 20 which is rigidly connected to a pin 21 extending through the torpedo casing 10 and connecting the two opposite parts of the pivoted rudder blade 17. A pair of springs 22 of equal strength tend to hold the rudder 17 in central position, as shown in the drawing.

The rudder 18 is pivoted upon a non-rotating rearward extension 23 of the casing 10 and its position is controlled by an arm 24 connected thereto, as shown in Figure 1. A pair of springs 25 of equal strength tend to hold the rudder 18 in central position.

As shown in Figure 2, the forward end of the arm 24 connected to the rudder 18 is positioned between a pair of electromagnets 26 and 27. The position of the rudder 18 is therefore controlled by these electromagnets and when one is energized to a greater extent than the other the rudder is swung to one side or the other. As shown in Figure 2, the arm 20 connected to the rudder 17 is positioned at its forward end between a pair of electromagnets 28 and 29. The position of the rudder 17 is therefore controlled by these electromagnets 28 and 29, and when one is energized to a greater extent than the other, the rudder 17 is swung to one side or the other. The electromagnets 26, 27, 28 and 29 may thus control the direction of movement of the torpedo in both a horizontal plane and a vertical plane.

Positioned forward of the compressed air tank 13 is a storage battery 30, one terminal of which is connected through a lead wire 31 to the coil of the electromagnet 26, through a lead wire 32 to the coil of the electromagnet 27, through a lead wire 33 with the coil of the electromagnet 28, and through a lead wire 34 with the coil of the electromagnet 29. The other terminal of the battery 30 is connected by a lead wire 35 with an armature 36, and by a lead wire 37 with an armature 38. The armatures 36 and 38 are pivoted at their centers as indicated at 39 and 40 respectively.

The pivoted armature 36 is provided at its ends with a pair of contact points 41 and 42. The contact 41 is adapted to make contact with the terminal of a lead wire 43 which passes to the winding of the electromagnet 27. When the armature 36 is swung therefore so that contact is made at 41, a circuit is completed from the battery 30 through the electromagnet 27, energizing this magnet, tending to draw the arm 24 in this direction. The contact point 42 on the armature 36 is adapted to make contact with the terminal of a lead wire 44

which is connected with the winding of the electromagnet 26. When the armature 36 is swung therefore so that contact is made at 42, a circuit is completed from the battery 30 through the electromagnet 26 and this electromagnet is energized, tending to draw the arm 24 in its direction.

The pivoted armature 38 is provided at its ends with contact points 45 and 46. The contact point 45 is adapted to make connection with the terminal of a lead wire 47 which is connected to the coil of the electromagnet 29. When the armature 38 is swung so that contact is made at 45 therefore a circuit is completed from the battery 30 through the electromagnet 29 which is thus energized and tends to draw the arm 20 toward itself, moving the rudder 17. The contact 46 is adapted to make contact with the terminal of a lead wire 48 which is connected with the winding of the electromagnet 28. When the armature 38 therefore is swung so that contact is made at 46, a circuit is completed from the battery 30 through the electromagnet 28 which is thus energized and tends to draw the arm 20 to swing the rudder 17. It will thus be seen that the direction of movement of the torpedo in both a vertical plane and horizontal plane may be controlled by making and breaking the contact at the points 41, 42, 45 and 46.

Positioned forwardly of the armatures 36 and 38, is a battery 49. One terminal of the battery 49 is connected through switch mechanisms, which will later be described in detail, thence through a lead 50 and by separate parallel leads 51, 52, 53 and 54 respectively with the terminals of microphones 55, 56, 57 and 58 respectively. The other terminal of the battery 49 is connected through a coil 59 and lead 60 with the other terminal of the microphone 55, through a coil 61 and lead 62 with the other terminal of the microphone 56, through a coil 63 and lead 64 with the other terminal of the microphone 57, and through a coil 65 and lead 66 with the other terminal of the microphone 58. The coil 59 is positioned about a core 67 forming part of the armature 36 so that when this coil is energized the armature 36 is swung to make contact at 42. The coil 61 is positioned about a core 68 forming part of the armature 36 so that when this coil is energized, the armature 36 is swung to make contact at 41. The coil 63 is positioned about a core 69 forming part of the armature 38 so that when this coil is energized, the armature 38 is swung to make contact at 46. The coil 65 is positioned about a core 70 forming part of the armature 38 so that when this coil is energized the armature 38 is swung to make contact at 45. The microphones 55, 56, 57 and 58 are

positioned adjacent the forward end of the torpedo, preferably in recesses therein, as shown, and are responsive to vibrations such as sound waves from the outside.

5 Sound waves striking any one of the microphones compress the carbon pile thereof, lessening its resistance and permitting a current to flow therethrough from the battery 49 energizing the coil through which the microphone is connected. The two
10 microphones 55 and 56 are preferably positioned in a plane substantially at right-angles to the rudder 18, whose position they control through the connections above described. It will be seen that sound waves
15 striking the microphone 55, for example, cause a current to flow through the coil 59 which swings the armature 36, making contact at 42. This energizes the electro-
20 magnet 26 which swings the rudder 18 to direct the torpedo in the direction from which the sound waves are proceeding. In like manner sound waves striking the micro-
25 phone 56, effect a turning of the rudder 18 to steer the torpedo toward the source of these sound waves, and sound waves striking the microphones 57 and 58, effect
30 a turning of the rudder 17 to steer the torpedo toward the source of these sound waves.

Thus the torpedo propelled through the water by the motor 34 is automatically steered toward a source of sound. The torpedo will thus travel toward a moving vessel the propeller of which creates a disturbance in the water and will follow the vessel even though it travels in a changing course until it strikes the vessel and explodes. When the torpedo is moving in the proper
40 course, directly toward its target, the microphones 55, 56, 57 and 58 being symmetrically disposed, receive the same intensity of sound wave from the target and the torpedo proceeds in a straight path toward the target.
45 Immediately, however, that the position of the source of sound changes with respect to the direction of movement of the torpedo, the rudder controlling mechanism is operated to correct the direction of travel.

50 For the sake of simplicity in construction, the two armatures 36 and 38 may be substituted, as shown in Figures 4 and 5, by a single plate 71 which is adapted to be attracted by electromagnets 59^a, 61^a, 63^a, and
55 65^a, in place of the coils 59, 61, 63 and 65 respectively. This armature plate 71 may be loosely mounted, as shown in Figure 5, upon a fixed supporting shaft 72. The action of these parts is substantially the same
60 as above described with regard to the armatures 36 and 38 of Figures 1 and 2, and their operation will readily be understood from the above.

65 Referring now to Figure 6, there is shown the compressed air reservoir 13, the motor 12

and a supply pipe 73 adapted to lead the compressed air from the tank to the motor to drive the latter. Interposed in this supply pipe 73 is a valve mechanism which is adapted to open and close to intermittently
70 cut off the supply of compressed air to the motor. This valve mechanism may take the form of a worm wheel 74 supported within a casing 75 and driven by a worm 76 secured upon a shaft 77 which is driven by suitable
75 mechanism within the motor 12. This worm wheel 74 has a circular segmental slot 78 therein which is adapted to register with the passage through the pipe 73. Thus, as the worm wheel 74 is slowly rotated, during
80 its period of rotation when the slot 78 is in registry with the pipe 73, power is delivered to the engine 12, but during the interval when the unslotted portion of the wheel registers with the pipe 73, the power supply
85 is cut off. During this latter interval, while the power supply to the engine is cut off, the inertia of the moving torpedo is sufficient to maintain its movement through the water, and the propeller 11, during this interval,
90 turns the engine over to keep the wheel 74 in rotation until the slot 78 again comes into registry with the supply pipe 73. The driving power being thus intermittently cut off from the motor 12, the vibration occasioned by the drive is intermittently
95 interrupted, and during this interval of interruption of the engine vibration, the microphones are afforded an opportunity to "listen" free from local sound waves from the torpedo itself to more efficiently pick up
100 the sound waves from the target and properly direct the course of the torpedo.

Referring again to Figure 1, one terminal of the battery 49, as was mentioned above,
105 is connected through certain switch mechanisms to the lead 50. One of these switch mechanisms is connected in series between the lead 50 and the battery 49 through a pair of leads 79 and 80. As shown in Figures 6
110 and 8, there is mounted adjacent the face of the gear wheel 74, a block of insulating material 81, which may be supported in any suitable manner. Supported upon this
115 block 81 are a pair of contact members 82 and 83 which are thus insulated from each other. The lead 80 is connected to the contact 83 and the lead 79 is connected to the contact 82 so that, without electrical connection between the contacts 82 and 83, the
120 circuits through the battery 49 and microphones 55, 56, 57 and 58 are broken.

Mounted upon the face of the wheel 78 is a circular segmental contact strip 84 which is insulated from the wheel 74, as
125 shown in Figure 6, and slides in a circular slot through the casing 75 as the wheel 74 rotates. This contact strip 84 is adapted to bridge the two contacts 82 and 83, making electrical connection therebetween as it ro-
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tates thereover, thus closing the microphone circuits. The contact strip 84 is of such length and is so positioned upon the wheel 74, that the microphone circuits are open when the slotted portion 78 is in registry with the supply pipe 73, and the microphone circuits are closed when the unslotted portion of the wheel 74 is in registry with the feed pipe 73. Thus, during the intervals when the engine 12 is being driven, the microphones are inoperative, and during the intervals when the power supply to the engine is cut off, and the engine vibrations cease, the microphones are operative to direct the path of the torpedo. In this manner an accurate steering by the "listening" microphones toward the target of the torpedo is had.

This torpedo may be launched in the usual manner, or it may be anchored in readiness to automatically start toward a target such as the vibrating propeller of a vessel. The engine of the torpedo being positioned adjacent the rear end thereof, the rear end is heavier than the forward end, so that the torpedo resting in the water tends normally to assume an endwise vertical position, as indicated in Figure 9. In this figure there is shown a simple form of anchoring means. Through the non-rotating extension 23, upon which the rudder 18 is pivoted, is formed a transverse opening 85. Through this opening extends a rod 86 which is pivoted at one end 87 to a housing 88. This housing 88 may be firmly anchored as by means of claws 89, for example. The upper wall of the housing 88 is formed preferably by a light cover 90, for example of sheet-metal forming a water-tight closure. The rod 86 at its end opposite the hinge 87 is sprung downwardly and interlocked with the housing 88 and the cover 90 and 91 in such manner that when the cover 90 is blown outwardly, as will be described, this end of the rod 86 and 91 is released.

Positioned in the wall of the housing 88 is a microphone 92 which is responsive to vibrations from the exterior. This microphone 92 is connected to a storage battery 93 and a coil 94 contained within the housing 88. Also within the housing 88 is a secondary circuit comprising a coil 95 adjacent the coil 94 and sparking points 96. In the bottom of the housing 88 is positioned a charge of explosive material 97 adjacent to which are positioned the sparking points 96. Thus when the microphone 92 is properly affected by vibrations from the exterior, a current is induced in the secondary coil 95 causing a spark at the points 96 and exploding the charge 97. This results in a blowing out of the cover 90, releasing the end of the rod 86 at 91, as above described. This, as will be seen, releases the torpedo from its anchorage. When the torpedo is thus anchored, it is

desirable that the circuits through the microphones 55, 56, 57 and 58 be normally opened in order to avoid unnecessary discharging of the battery 49. Referring again to Figure 1 the forward terminal of the battery 49 is seen to be connected through a lead 125 to the contact member 129 of a switch mechanism the other contact member 130 of which is connected by a lead 126 with the lead 79. This switch mechanism is actuated by a diaphragm 128 positioned in the casing 10 and exposed to sound vibrations from the exterior. These parts are shown more clearly, and in larger detail, in Figures 12 and 13. Referring to these figures, the sound responsive diaphragm 128 has connected thereto a light arm 131, the end of which engages the periphery of a wheel 132. This wheel 132 is rotatably mounted upon a stationary shaft 133 which may be of light construction and fixed and supported in any suitable manner. The periphery of the wheel 132 is provided with fine ratchet teeth with which the end of the arm 131 coacts. The arm 131 may be of light resilient material, for example a lead spring which bears lightly upon the periphery of the wheel. Sound vibrations striking the diaphragm 128 result in a rapid vibration of the diaphragm which transmitted through the arm 131 to the ratchet wheel 132, rotates the ratchet wheel in the direction indicated by the arrow in Figure 12.

When the torpedo is at anchorage, being in an upright end-wise position, these parts are as illustrated in Figure 12. The ratchet toothed periphery of the wheel 132 is flanged over as shown at 132^a in Figure 13 and this peripheral flange 132^a is provided with an internal gear 134. Rotatably mounted upon the shaft 133 is a second wheel 135 which is positioned within the flange 132^a and has about its periphery gear teeth similar to, and positioned opposite the internal gear 134. Interposed between the wheel 135 and the peripheral flange 132^a is a small pinion or gear 136 which meshes with the internal gear 134 and the teeth of the gear 135.

The wheel or gear 135 has a central hub 135^a about the shaft 133 and loosely mounted upon the shaft within this hub is a collar 137 which, as shown in Figure 12, has a depending contact arm 138. Interposed between the inner surface of the hub 135^a and the surface of the collar 137 is a hair-spring 139. The two contact members 129 and 130 to which are connected the respective leads 125 and 126, as shown in, and above described with regard to Figure 1 are positioned adjacent the contact arm 138. Normally while the torpedo is at anchorage the parts are in the position shown in Figure 12, there being no connection between the contact members 129 and 130 and hence no connection between the leads 125 and 126 so that the circuits

through the microphones 55, 56, 57 and 58 are therefore incomplete. A rotation of the collar 137, however, in a clockwise direction, as viewed in Figure 12, will bring the arm 138 across the contacts 129 and 130 completing the microphone circuits.

Normally the gear 136 is preferably positioned with respect to the center of rotation of the wheels 132 and 135 substantially as shown in Figure 12. When the diaphragm 128 is affected by vibrations from the exterior as by those from the propeller of a vessel, its vibrations are transmitted through the arm 131 and rotate the wheel 132 in the direction indicated by the arrow. This rotation is comparatively slow and the small gear 136 is not rotated thereby about its own axis, but serves temporarily as a fixed connection between the wheel 132 and the wheel 135 rotating the latter with the former and in the same direction. In order to insure the non-rotation of the small gear 136 about its own axis at this stage, it is provided with an air vane 140 secured to an axial pin 141 thereon. This rotation of the wheel 135 with the wheel 132 through the hair-spring 139 turns the collar 137 moving the contact arm 138 into contact with the members 129 and 130, making electrical connection therebetween. The circuits through the microphones are therefore closed and the microphones are rendered operative to control the torpedo.

Providing the vibrations which affect the diaphragm 128 as above described to close the circuit between the contacts 129 and 130 are not sufficient to effect the release and launching of the torpedo, and providing these vibrations thereafter cease, a means is provided for again opening the circuit at the contacts 129 and 130 and restoring the parts to normal position with the battery 49 on open circuit. Mounted upon the wheel 135 is a small weight 142 which, as soon as the vibratory drive from the diaphragm 128 to the wheel 132 ceases, rotates the wheel 135 back in a counter clockwise direction. The arm 131 prevents the wheel 132 from rotating in a counter clockwise direction, but during such rotation of the wheel 135 the gear 136 rotates slowly about its axis permitting relative rotation of the two wheels. As the wheel 135 thus rotates counter clockwise the contact arm 138 is moved again to the position shown in Figure 12 and the parts are in position to again close the circuit upon vibration of the diaphragm 128.

Thus, when the torpedo is placed at anchor, the listening microphones 55, 56, 57 and 58 are inoperative. As soon however as the diaphragm 128 is vibrated in response to vibrations such as those proceeding from the propeller of a vessel, contact is made between the leads 125 and 126 by the contact arm 138 completing the mi-

crophone circuits and rendering them operative to control the torpedo. When the torpedo has been released from its anchorage and automatically started toward its target, as will presently be described, the torpedo 70 assumes a lateral position substantially as shown in Figure 2 in moving through the water. As shown in Figure 12, there is preferably provided a small casing 143 which may be spherical in shape and into which 75 projects a wire 144 from the lead 125 and a wire 145 from the lead 126. Within this casing is provided mercury 146 which more than half fills the casing, surrounding the wire 144, but not the wire 145 when the 80 torpedo is in endwise position at anchorage. When the torpedo assumes a lateral position moving through the water the mercury 146 assumes a different position within the casing 143 surrounding both the wires 145 85 and 144. Electrical connection is therefore made through the mercury through the leads 125 and 126 short circuiting the contacts 129 and 130. Thus after the torpedo is launched and is moving through the water, 90 the contact arm 138 is no longer relied upon to maintain the electrical connection between the leads 125 and 126 to render the microphones operative.

When the torpedo is at anchor, as above 95 described, the gear wheel 74 is so positioned that the contact strip 84 thereon bridges the contacts 82 and 83 closing thereat the circuits of the microphones 55, 56, 57 and 58. The supply pipe 73 to the motor 12 is thus 100 closed, the motor being at rest and the propeller 11 stationary. The parts are shown in this position in Figures 10 and 11. In Figure 10, there is also shown a mechanism for automatically starting the propulsion 105 of the torpedo from its anchorage, which mechanism is omitted in Figure 6, for the sake of clarity in the drawings. There is shown a by-pass pipe 98 for the feed pipe 73 connected thereto at either side of the gear wheel 74. Within this pipe 98 is a 110 valve 99, for example, of the butterfly type shown. Thus when the valve 99 is opened regardless of the gear wheel 74 closing the main passage to the engine 12, a supply of compressed air is admitted to the engine. 115 This is employed in starting the torpedo from anchorage, as will be described.

The parts, as shown in Figures 10 and 11, are in what may be termed starting position, that is their position when the torpedo 120 is at anchor. As has been mentioned, the contact member 84 is bridged across the contacts 82 and 83 so that the circuits of the microphones 55, 56, 57 and 58 are closed 125 thereat. The valve 99 is operated by a lever 100 which is normally held in closing position by a pivoted latch 101 and a spring 102. Connected across the contacts 82 and 83 by 130 leads 103 and 104 is the coil of an electro-

magnet 105. This magnet 105 is positioned so that when energized, it attracts the latch 101 lifting the latch away from the valve controlling lever 100.

5 Connected to the contact 83 is a lead 107 passing to one end of a second electromagnet 108, from the other end of which passes a lead 106 to a contact member or brush 106^a. This brush 106^a is positioned
10 to contact the contact strip 84 when the latter rotates thereby. In the starting position, as shown in Figures 10 and 11, these parts 106^a and 84 are in contact so that the circuit through the electromagnet 108 is
15 complete. This magnet is positioned so that when energized it attracts the valve controlling lever 100 to open the valve 99. The spring 102 tends to draw the valve toward closed position, but is not of sufficient
20 strength to overcome the pull of the magnet 108. A spring 109 tends to hold the latch 101 down, but is not of sufficient strength to overcome the pull of the magnet 105 when the latter is energized.

25 Normally the torpedo being anchored and the water about the microphones 55, 56, 57 and 58 being substantially free from sound vibrations, the microphones are on open circuit and inoperative, the circuit-
30 closing mechanism shown in Figures 12 and 13 being open. As soon, however, as sound waves, as from the propeller of a vessel, affect the diaphragm 128 causing the arm
35 138 to move against the contact members 129 and 130, the microphones are rendered operative. These sound waves affecting one or more of the microphones cause current to flow therethrough from the battery 49. This
40 current energizes the electromagnets 105 and 108. The electromagnet 105 lifts the latch 101 and the electromagnet 108 thereupon immediately opens the valve 99 and the engine 12 is started. The coil of the electromagnet
45 105 is connected through a pair of contacts 110 and 111, the contact 111 being carried upon a lever 112 pivoted at 113. This lever 112 is urged to swing in a counterclockwise direction by a spring 114 to break the circuit of the electromagnet 105, but is normally
50 restrained from such swinging by contact with a lever 115 pivoted at 116. This lever 115 is pivoted at 117 to the latch 101. Upon the latch 101 moving upwardly under the urging of the magnet 105, as above described, the right-hand end of the lever 115
55 moves downwardly, permitting the lever 112 to slip thereover under the urge of the spring 114 and to swing to the dotted line position, breaking the circuit of the magnet 105. The latch 101 therefore immediately
60 drops to its normal position.

At this point the electromagnet 108 is operative to hold the valve 99 open. The engine 12 is therefore driven and the gear
65 wheel 74 starts to rotate. As soon as the

gear wheel 74 rotates until the contact strip 84 moves out of engagement with the contact member 106^a, the electromagnet 108 is de-energized. This permits the spring 102 to draw the valve 99 to closed position, the
70 top of the lever 100 slipping beneath the latch 101 and the latter again dropping into locking position. It will be seen that thereafter further energizing of the coil 108, when the contact strip 84 again moves into
75 engagement with the contact 106^a, will be ineffective to open the valve 99 against the action of the latch 101. The breaking of engagement between the contact strip 84 and the contact 106^a occurs just as the slotted
80 portion 78 of the gear wheel 74 moves into registry with the pipe 73. Thereafter the by-pass pipe 98 is inoperative and the torpedo is driven, as above described, with intermittent propulsion of the motor.

85 Preferably the microphones 55, 56, 57 and 58 are made more sensitive than the microphone 92, which acts to cause the release of the anchoring means. Thus before, the torpedo is released, the microphones 55, 56,
90 57 and 58 may operate to start the drive of the motor and the rotation of the propeller and to adjust the rudders 17 and 18 so as to properly direction the torpedo before it is released. As shown in Figure 9, the opening
95 85 through which the anchoring rod 86 extends, is preferably enlarged at each end so that this directioning of the torpedo, while still anchored, may take place. The torpedo having been released from its anchorage by the microphone 92 operating, as
100 has been described, will thereupon travel toward its target with a high degree of accuracy.

105 From the above it will be seen that there are herein provided an art and apparatus for carrying on the same which embody the features of this invention and attain the objects thereof, and that the same are well adapted to meet the requirements of practical
110 operation. It may be here noted that the term "torpedo" as employed herein is to be interpreted in a broad sense throughout to comprehend generally devices of the nature of a torpedo or other projectile
115 adapted to move through the water or air to strike a target with destructive effect.

As many possible embodiments may be made of the mechanical features of the above invention and as the art herein described might be varied in various parts all without departing from the scope of the invention, it is to be understood that all
120 matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim as my invention:—

1. In apparatus of the character described, in combination, a torpedo, means for propelling said torpedo, means responsive to
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sound vibrations adapted to control the direction of movement of said torpedo, and means adapted intermittently to render ineffective said propelling means during movement of said torpedo.

2. In apparatus of the character described, in combination, a torpedo, means for propelling said torpedo, means responsive to sound vibrations adapted to control the direction of movement of said torpedo, and means adapted intermittently to render said controlling means ineffective during movement of said torpedo.

3. In apparatus of the character described, in combination, a torpedo, means for propelling said torpedo, means responsive to sound vibrations adapted to control the direction of movement of said torpedo, means adapted intermittently to render said propelling means ineffective during movement of said torpedo, and means adapted to render said controlling means effective while said propelling means is ineffective and to render said controlling means ineffective while said propelling means is effective.

4. In apparatus of the character described, in combination, a torpedo, means for anchoring said torpedo, and automatic means adapted to cause said torpedo at anchorage to point toward a target.

5. In apparatus of the character described, in combination, a torpedo, means for anchoring said torpedo, and means responsive to sound vibrations adapted to cause said torpedo at anchorage to point toward the source of said vibrations.

6. In apparatus of the character described, in combination, a torpedo, means for anchoring said torpedo, and means adapted upon the approach of a vessel to cause said torpedo at anchorage to point toward said vessel.

7. In apparatus of the character described, in combination, a torpedo, means for anchoring said torpedo, means adapted upon the approach of a vessel to cause said torpedo at anchorage to point toward said vessel, and means adapted subsequently upon the closer approach of said vessel to release said torpedo from said anchoring means.

8. In apparatus of the character described, in combination, a torpedo, means for anchoring said torpedo, means contained within said torpedo and normally inoperative adapted to propel said torpedo, means adapted upon the approach of a vessel to render operative said normally inoperative propelling means and means adapted subsequently to release said torpedo from said anchoring means.

9. In apparatus of the character described, in combination, a torpedo, means for anchoring said torpedo, means contained within said torpedo and normally inoperative adapted to propel said torpedo, sound

responsive means adapted to steer said torpedo toward a source of sound, means adapted upon the approach of a vessel to render operative said normally inoperative propelling means, and means adapted subsequently to release said torpedo from said anchoring means.

10. In apparatus of the character described, in combination, a torpedo, means for anchoring said torpedo, means contained within said torpedo and normally inoperative adapted to propel said torpedo, sound responsive means normally inoperative adapted to steer said torpedo toward a source of sound, means adapted upon the approach of a vessel to render operative said normally inoperative sound responsive means and to render operative said normally inoperative propelling means, and means adapted subsequently to release said torpedo from said anchoring means.

11. The herein described art which consists in launching a self-propelled torpedo, subjecting the path of movement thereof to control by vibration responsive means, and intermittently interrupting the propulsion of said torpedo during movement thereof.

12. The herein described art which consists in launching a self-propelled torpedo, intermittently interrupting the propulsion of said torpedo during movement thereof, and subjecting the direction of movement of said torpedo to adjustment by vibration responsive means during interruption of said propulsion.

13. The herein described art which consists in launching a self-propelled torpedo, and intermittently and substantially simultaneously interrupting the propulsion of said torpedo and subjecting the direction of movement thereof to adjustment by means responsive to sound vibrations proceeding from its target.

14. The herein described art which consists in anchoring a torpedo, and subjecting the position of said torpedo at anchorage to adjustment by vibration responsive means to point said torpedo toward an approaching vessel.

15. In apparatus of the general nature of that herein described, in combination, a diaphragm adapted to be exposed to sound vibrations and responsive thereto, an electric circuit, and mechanical means actuated by vibrations of said diaphragm adapted to close said circuit.

16. In apparatus of the general nature of that here in described, in combination, an electric circuit, a switch in said circuit, a diaphragm adapted to be exposed to sound vibrations and responsive thereto, and a rotatable member adapted to be rotated by vibrations of said diaphragm and adapted to control said switch.

17. In apparatus of the general nature of

that herein described, in combination, a torpedo, sound responsive means adapted to control the direction of movement of said torpedo, and a second sound responsive means adapted to render said last means operative.

18. In apparatus of the general nature of that herein described, in combination, a torpedo, means for anchoring said torpedo, means for propelling said torpedo, means adapted to start propulsion of said torpedo from anchorage, and a mechanically operated device responsive to sound vibrations adapted to render said last means operative.

19. In apparatus of the general nature of that herein described, in combination, a torpedo, an electric circuit normally inoperative adapted when operative to control the movement of said torpedo, and a mechanically operated device responsive to sound vibrations adapted to render said electric circuit operative.

20. In apparatus of the character described, in combination, a torpedo, means for anchoring said torpedo, means contained within said torpedo and normally inoperative adapted to propel said torpedo, means for steering said torpedo, means responsive to sound vibrations adapted to control said steering means to guide said torpedo toward a source of sound, means responsive to sound vibrations adapted to render operative said normally inoperative propelling means, and means responsive to sound vibrations adapted to release said torpedo from said anchoring means, said first two sound responsive means being more sensitive than said last sound responsive means.

21. In apparatus of the character described, in combination, a torpedo, means for propelling said torpedo, electrical means normally inoperative adapted to start the actuation of said propelling means, means for steering said torpedo, sound responsive electrical means normally inoperative adapted to control said steering means to guide said torpedo toward a source of sound, and mechanically operated means responsive to sound vibrations adapted to render said two electrical means operative.

22. In apparatus of the character described, in combination, a torpedo, means contained within said torpedo and normally inoperative adapted to propel said torpedo, means responsive to sound vibrations adapted to propel said torpedo, means responsive to sound vibrations adapted to start said propelling means, means responsive to sound vibrations adapted to steer said torpedo toward a source of sound, and means adapted at intervals to interrupt and re-start said propelling means during movement of said torpedo.

23. In apparatus of the character described, in combination, a torpedo, a motor therein, a propeller at the rear end of said torpedo adapted to be driven by said motor to propel said torpedo, means at the rear end of said torpedo adapted to steer said torpedo, sound responsive means adjacent the forward portion of said torpedo connected to control said steering means and adapted to steer said torpedo toward a source of sound, and means adapted at intervals during movement of said torpedo to interrupt the drive of said motor.

24. In apparatus of the character described, in combination, a torpedo, a motor therein, a propeller at the rear end of said torpedo adapted to be driven by said motor to propel said torpedo, means at the rear end of said torpedo adapted to steer said torpedo, sound responsive means adjacent the forward portion of said torpedo connected to control said steering means and adapted to steer said torpedo toward a source of sound, means adapted at intervals during movement of said torpedo to interrupt the drive of said motor and means adapted to render said sound responsive means operative while said motor drive is inoperative and to render said sound responsive means inoperative while said motor drive is operative.

In testimony whereof, I have signed my name to this specification this 27th day of May, 1924.

ROBERT S. BLAIR.